



Traffic Volume and ADT Analysis for Selected Roundabout in Baghdad City

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General Note



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ABSTRACT

This research represents the study of traffic volumes for a selected roundabout within the city of Baghdad and includes traffic volumes for each approach in the morning and evening rush hours for a period of three months and includes ADT. For traffic volume results, maximum traffic volumes are observed on the East approach (Al-Jihad Street), of (2023 pcu/hr) for morning peak periods (7:30-8:30) p.m. and (2060 pcu/hr) for evening peak periods on West approach. Also the Average Daily Traffic (ADT) for North, South, East and West approaches are (1034 veh/day), (1456 veh/day), (1559 veh/day) and (1741veh/day) respectively.

1. INTRODUCTION

The traffic congestion in the roundabouts has become a big problem especially in the peak hours in the morning and evening due to the obvious growth in the composition of vehicles, the lack of adherence to regulations and traffic laws. It will be difficult to get

regular traffic flows, which is why traffic police need to intervene to regulate traffic and turn the roundabout into a signalized intersection, other elements affecting the roundabout capacity such as ineffective engineering design and consequences of bad development and lack of proper attention by the government to plan appropriate transport to solve congestion problems. Traffic roundabout capacity is assessed for traffic movement, to give a clear idea to the expert authorities of design and planning.

2. STUDY AREA

2.1. Al Turkmani Roundabout

The Turkmani Roundabout is considered one of the largest intersections in the Baghdad City Center, in addition to its importance in linking eastern Baghdad districts through Palestine Street to the main center of Baghdad, which includes important government departments in addition to the educational institutes (Al-Mustansiriya University) and important commercial centers. This intersection has four entrances and exits, and the traffic density is high throughout official working hours. Plate (1) shows Al-Turkmani roundabout.



Plate 1 Al Turkmani Roundabout

3. GEOMETRIC DESIGN DATA

Due to the difficulty of obtaining the maps of the intersection in the design department in the Municipality of Baghdad and the absence of new maps, field measurements were made of the design characteristics of the circular intersection, which included the number of lanes for each approach in the roundabout, lane width, exit width, circular width, approximates half the width and additional features. It was measured from digital maps (Google Earth) and standardized by ground measurements, such as contribution angle, actual glow length, then input radius as shown in Figure (1). The main geometrical features of the circuits specified in Table (1) are presented.

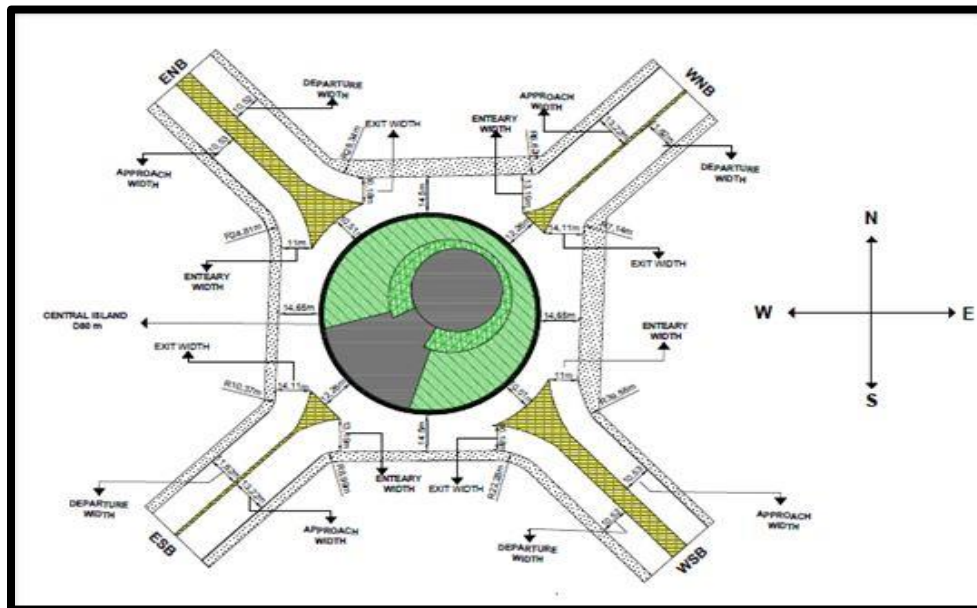


Fig.1 Geometric Elements for Al-Turkmani Roundabout

Table 1 Geometric properties for the Selected Roundabout

| Roundabout Name | Approach | Entrance width meter | No. of Entrance lane | Exit width Meter | Splitter island meter | No. of cycling lane | Cycling width meter | Flare length meter | Central island radius meter |
|------------------------|----------|----------------------|----------------------|------------------|-----------------------|---------------------|---------------------|--------------------|-----------------------------|
| AL-TURKMANI ROUNDABOUT | NE | 13.19 | 3 | 14.11 | 1 | 4 | 12.26 | 13.91 | 40 |
| | SE | 11 | 3 | 10.18 | 6 | 3 | 10.51 | 21.64 | 40 |
| | NW | 11 | 3 | 10.18 | 6 | 3 | 10.51 | 28.56 | 40 |
| | SW | 13.19 | 3 | 14.11 | 1 | 4 | 12.26 | 17.04 | 40 |

4. PEAK HOUR TIME DETERMINATION

One hours per period. The period was chosen is one-hour morning and one-hour evening for three consecutive months. Traffic data was calculated on official working days (Sunday, Monday, Tuesday, Wednesday, Thursday). Five days a week there were no abnormal security activities, no accidents. The weather will be fine, all recordings without rain and visibility conditions are good.

Table 2 Traffic Survey Periods

| Roundabout | Period of Survey | Date of Survey | Days | Time | | Total Hours |
|------------------------|------------------|-------------------|-----------|------|----|-------------|
| | | | | AM | PM | |
| AL-TURKMANI ROUNDABOUT | January | 20/1 to 31/1 2019 | Sunday | 1 | 1 | 2 |
| | | | Monday | 1 | 1 | 2 |
| | | | Tuesday | 1 | 1 | 2 |
| | | | Wednesday | 1 | 1 | 2 |
| | | | Thursday | 1 | 1 | 2 |
| | February | 17/2 to 28/2 2019 | Sunday | 1 | 1 | 2 |
| | | | Monday | 1 | 1 | 2 |

| | | | | | | |
|--|-------|------------------|-----------|---|---|---|
| | | | Tuesday | 1 | 1 | 2 |
| | | | Wednesday | 1 | 1 | 2 |
| | | | Thursday | 1 | 1 | 2 |
| | March | 3/3 to 14/3 2019 | Sunday | 1 | 1 | 2 |
| | | | Monday | 1 | 1 | 2 |
| | | | Tuesday | 1 | 1 | 2 |
| | | | Wednesday | 1 | 1 | 2 |
| | | | Thursday | 1 | 1 | 2 |

5. METHOD OF DATA COLLECTION

Traffic data at the intersection was recorded using AHD video cameras installed on the front of buildings opposite the intersection, recording data on 12 mm video tapes and storing files within the hard drives in the camera's recording unit. The benefit of data collection in this way is the possibility of accessing and retrieving the data at any time, acting as a record to re-evaluate the results, in addition to reducing the human errors that result from the data collection manually.

The data collection equipment consists of:

- 1) 2 Aswar camera 12-mm
- 2) 4 Data storage unit (1000 GB)
- 3) connected wires



Fig.2 Camera Location and Recording Process for Al Turkmani Roundabout

The best points were chosen for the cameras to obtain the best clarity for the recordings and the intersection coverage to be fully connected to all the entrances and exits. A building was chosen overlooking the intersection. Two cameras were placed in parallel.

6. TRAFFIC VOLUME DATA

This data contains counting the volumes of Traffic which have been take out from video recordings for the roundabout then the volumes of rotating movements. The traffic movements on the approaches or legs and traffic volumes in terms of passenger car

units remain essential for the analysis drives. Therefore, the traffic volumes converted by using conversion factors. These factors for converting numerous types of vehicles into PCU equivalents (SORB 1982) are shown in Table (3).



Fig.3 Aerial Image of Al Turkmani Roundabout

Table 3 Conversion Factors to Pcu, (SORB, 1982)

| Class of vehicle | Flat Terrain |
|--|--------------|
| Motorcycle | 0.5 |
| Private car and taxi | 1.0 |
| Pick-up , van, and bus up to 24 passengers | 1.25 |
| Truck and trailer combination | 2.0 |
| Heavy vehicle | 3.0 |

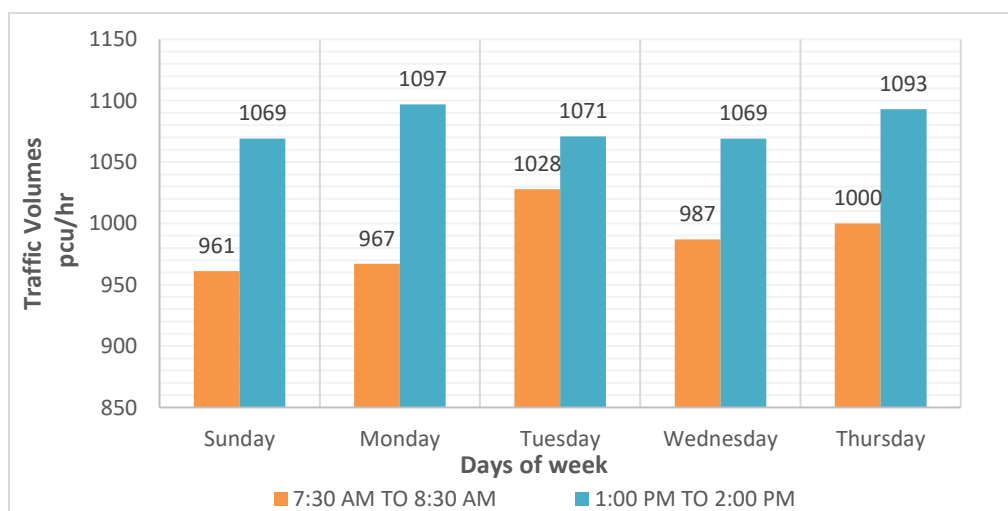


Figure 4 Average Traffic Volumes from North Approach for three Months

7. TRAFFIC VOLUME ANALYSIS

The traffic counting process continued for three months to obtain results with high level of accuracy of the traffic flow for the selected roundabout in this study, in addition to access to the ADT value of the intersection, where the movement of each leg was calculated by following the video recordings because there is no possibility of counting using the appropriate programs since they need to install video recording equipment vertically on the leg or roundabout.

7.1. North Approach (Jamal Al-Din Street)

The traffic volume variation over a week from Sunday to Thursday is different from the morning peak hour (7:30-8:30) am to evening peak hour (1:00-2:00) pm, the traffic volume for this Approach was 1028 (Pcu/hour) for (7:30-8:30) am its highest value of volume in all days of week for morning peak, and 1071(Pcu/hour) for (1:00-2:00) pm on Tuesday and the lowest traffic volume was 961 (Pcu/hour) for (7:30-8:30) am on Sunday due to the high volumes at the Approaches (eastern and southern Approaches) in the morning rush hour, during the evening rush hour the highest traffic volume was 1097 (Pcu/hour) for (1:00-2:00) pm on Monday and less traffic volume was 1069 (Pcu/hour) for (1:00-2:00) pm on Sunday Figure (4) shows the traffic volume during the three-month peak hours (January, February, March) 2019.

Figure (5) presents the variation of traffic volume as a percentage of average daily traffic within a week for the north approach.

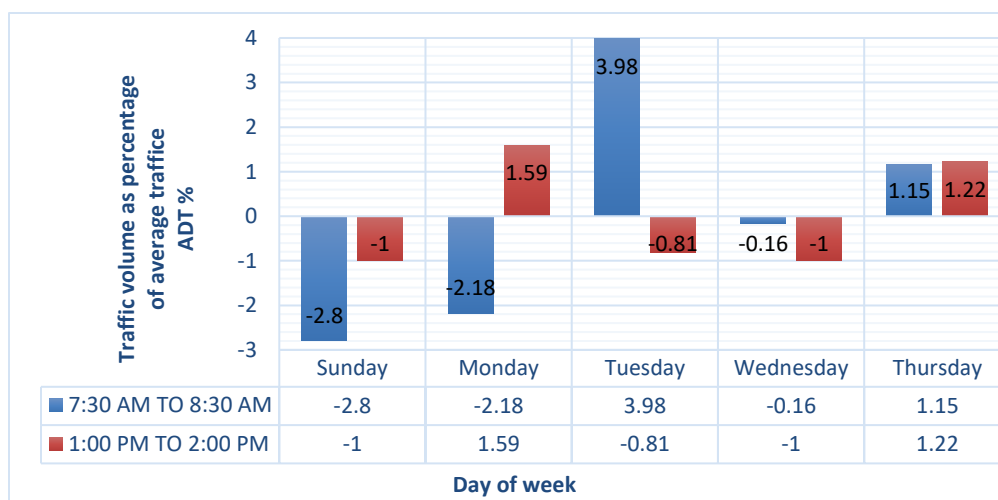


Fig.5 Variation of Traffic Volume as Percentage of ADT North Approach

A higher percentage of (3.98 %) is obtained for the north approach during the rush morning hour (7:30-8:30) am on Tuesday and (1.59 %) during the rush evening hour (1:00-2:00) pm on Monday. Also, it is obvious from the figure above there is no significant differences and all days (Sunday, Monday, Wednesday, Thursday) for morning rush hour (7:30-8:30) am, and (Sunday, Tuesday, Wednesday, Thursday) for evening rush hour (1:00-2:00) pm, provided approximately the same percentages of traffic volume rang from (961) pcu/hr to (1000) pcu/hr in morning rush hour, and from (1069) pcu/hr to (1093) pcu/hr in evening rush hour which indicated little flow variation and high traffic volumes.

7.2. East Approach (Al-Jihad Street)

The traffic volume variation over a week from Sunday to Thursday is different from the morning peak hour (7:30-8:30) am to evening peak hour (1:00-2:00) pm, the traffic volume for this Approach was 2023 (Pcu/hour) for (7:30-8:30) am its highest value of volume in all days of week for morning peak, and 1192 (Pcu/hour) for (1:00-2:00) pm on Monday and the lowest traffic volume was 1889 (Pcu/hour) for (7:30-8:30) am on Wednesday, the highest traffic volumes recorded from East Approach during the morning rush hour this is due to the connectivity of east approach to the nearby Palestine arterial street, which passes high number of daily trips. , during the evening rush hour the highest traffic volume was 1192 (Pcu/hour) for (1:00-2:00) pm on Monday and less traffic volume was 1115 (Pcu/hour) for (1:00-2:00) pm on Thursday, Figure (6) shows the traffic volume during the three-month peak hours (January, February, March) 2019.

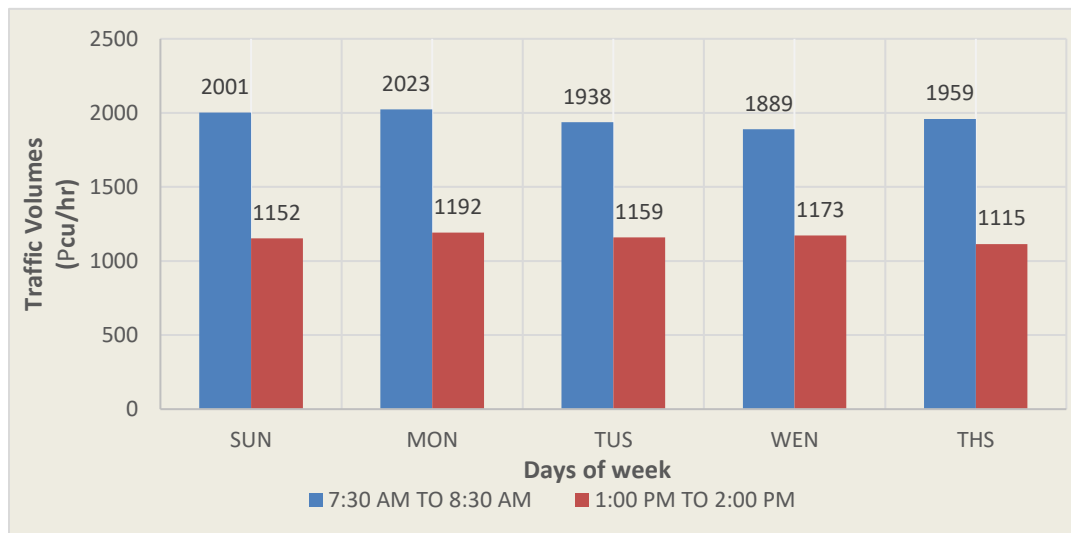


Fig.6 Average Traffic Volumes from East Approach for three months

Figure (7) presents the variation of traffic volume as a percentage of average daily traffic within a week for East approach.

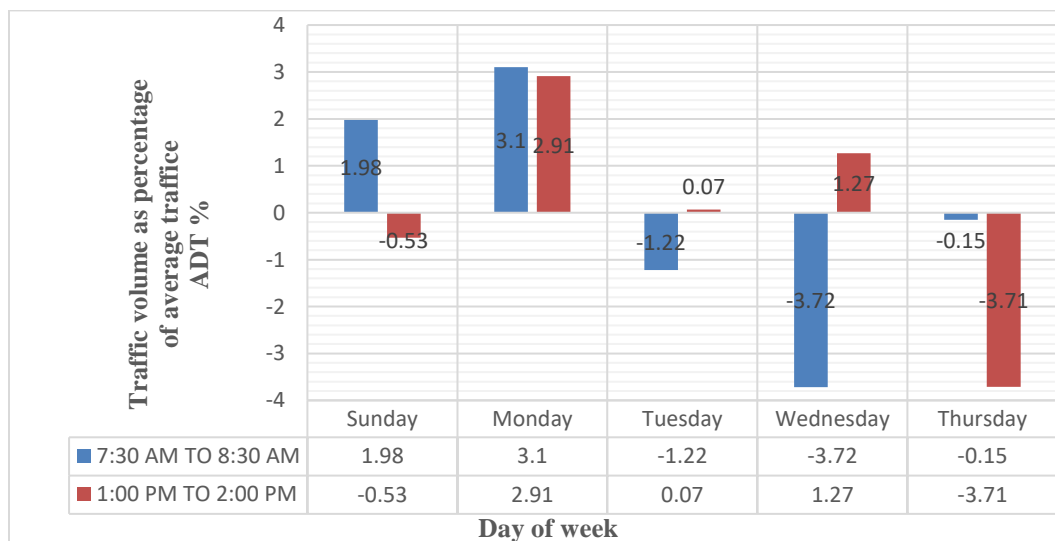


Fig.7 Variation of Traffic Volume as Percentage of ADT East Approach

A higher percentage of (-3.72 %) is obtained for the east approach during the rush morning hour (7:30-8:30) am on Wednesday. And (-3.71 %) during the rush evening hour (1:00-2:00) pm on Thursday. Also, it is obvious from the figure above there is no significant differences and all days (Sunday, Monday, Tuesday, Thursday) for morning rush hour (7:30-8:30) am, and (Sunday, Monday Tuesday, Wednesday,) for evening rush hour (1:00-2:00) pm, provided approximately the same percentages of traffic volume rang from (1938) pcu/hr to (2023) pcu/hr in morning rush hour, and from (1152) pcu/hr to (1192) pcu/hr in evening rush hour which indicated little flow variation and high traffic volumes.

7.3. West Approach (Al-Jihad Street)

The traffic volume variation over a week from Sunday to Thursday is different from the morning peak hour (7:30-8:30) am to evening peak hour (1:00-2:00) pm, the traffic volume for this Approach was 1531 (Pcu/hour) for (7:30-8:30) am its highest value of volume in all days of week for morning peak, and 2060 (Pcu/hour) for (1:00-2:00) pm on Wednesday and the lowest traffic volume was 1456 (Pcu/hour) for (7:30-8:30) am on Thursday, during the evening rush hour the highest traffic volume was 2060 (Pcu/hour) for (1:00-2:00) pm on Wednesday and less traffic volume was 1948 (Pcu/hour) for (1:00-2:00) pm on Thursday, Figure (8) shows the traffic volume during the three-month peak hours (January, February, March) 2019.

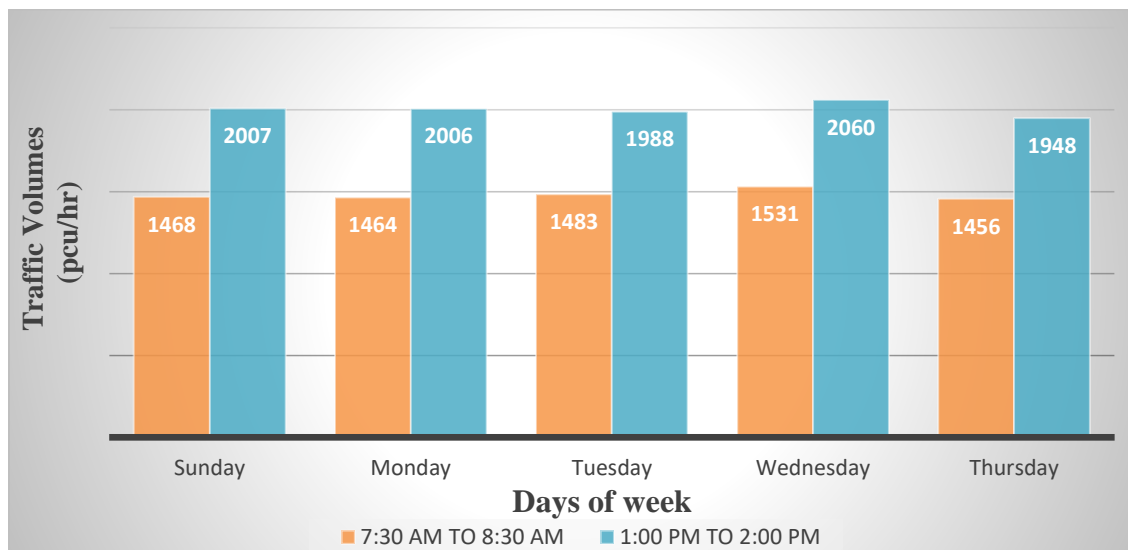


Fig.8 Average Traffic Volumes from West Approach for January Month

Figure (9) presents the variation of traffic volume as a percentage of average daily traffic within a week for the west approach.

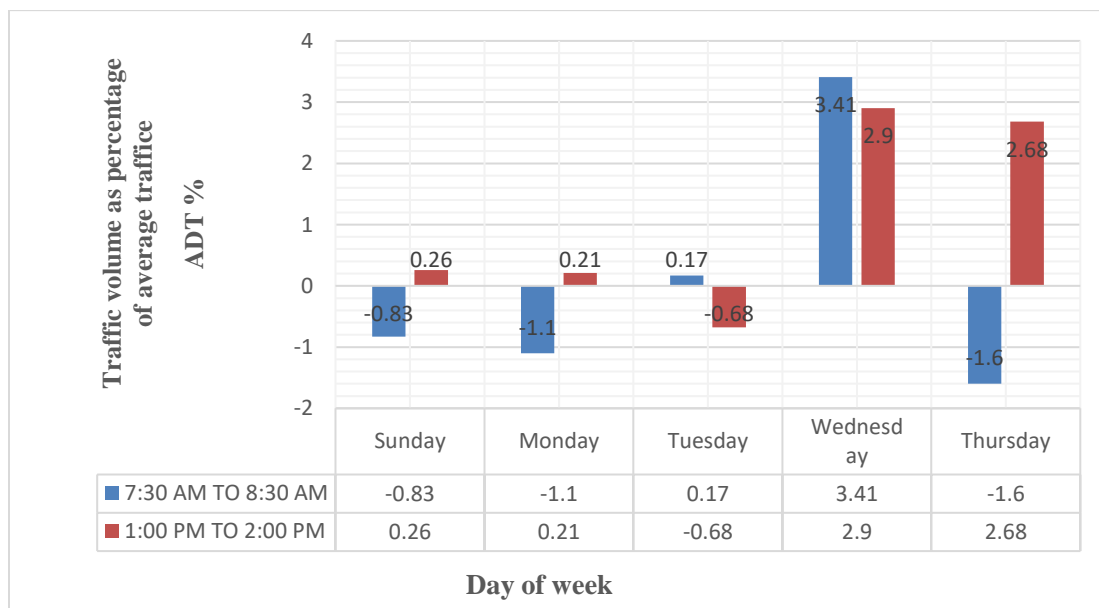


Fig.9 Variation of Traffic volume as Percentage of ADT West Approach

A higher percentage of (3.41%) is obtained for the west approach during the rush morning hour (7:30-8:30) am on Wednesday. And (2.9%) during the rush evening hour (1:00-2:00) pm on Wednesday. Also, it is obvious from the figure above there is no significant differences and all days (Sunday, Monday, Tuesday, Thursday) for morning rush hour (7:30-8:30) am, and (Sunday, Monday Tuesday, Thursday,) for evening rush hour (1:00-2:00) pm, provided approximately the same percentages of traffic volume rang from (1456) pcu/hr to (1483) pcu/hr in morning rush hour, and from (1948) pcu/hr to (2007) pcu/hr in evening rush hour which indicated little flow variation and high traffic volumes.

7.4. South Approach (Jamal Al-Din Street)

The highest traffic volume for this approach was (1728) Pcu/hour for the morning rush hour (7:30-8:30) am on Sunday, the lowest traffic volume was (1621) Pcu/hour for the evening rush hour (1:00-2:00) pm, This Approach is effective in the morning rush hours, especially the traffic volumes towards the west because most of the traffic volumes are towards (Bab al-Muadham) station which attracted large daily trips (Educational and work trips),while during the evening rush hour the highest traffic volume was on Thursday (1292) Pcu/hour (1:00-2:00) pm, and less Traffic volume was on Sunday (1211) Pcu/hour (1:00-2:00) pm, Figure (10) shows the average traffic volume for the three-month peak hours (January, February, March) 2019.

A higher percentage of (3.98%) is obtained for the south approach during the rush morning hour (7:30-8:30) am on Sunday. And (3.34%) during the rush evening hour (1:00-2:00) pm on Thursday. Also, it is obvious from the figure above there is no significant differences and all days (Monday, Tuesday, Wednesday, Thursday) for morning rush hour (7:30-8:30) am, and (Sunday, Monday Tuesday, Wednesday,) for evening rush hour (1:00-2:00) pm, provided approximately the same percentages of traffic volume rang from (1621) pcu/hr to (1673) pcu/hr in morning rush hour, and from (1211) pcu/hr to (1260) pcu/hr in evening rush hour which indicated little flow variation and high traffic volumes.

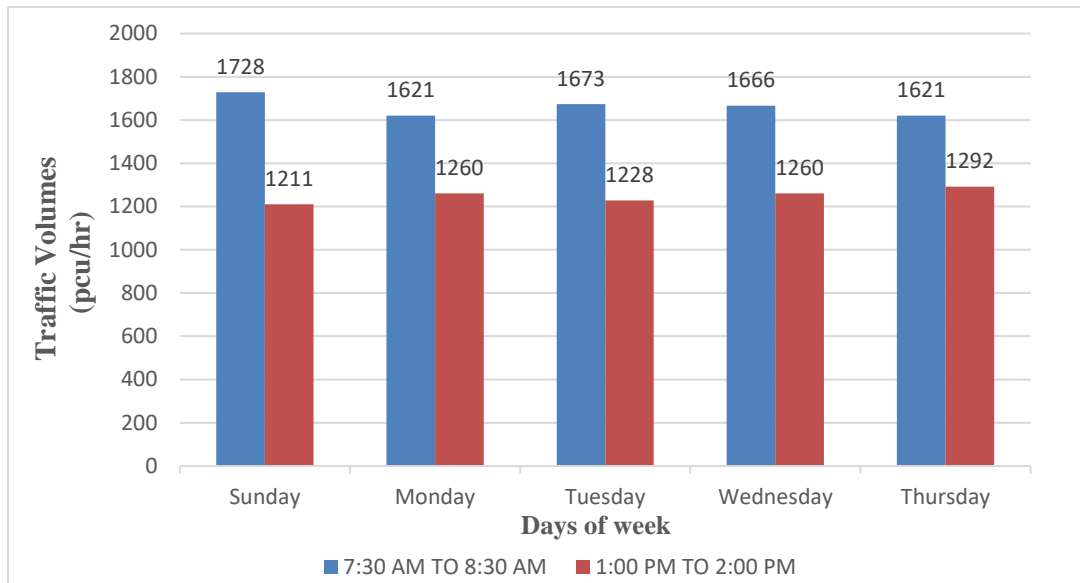


Fig.10 Average Traffic Volumes from South Approach for January Month

Figure (11) presents the variation of traffic volume as a percentage of average daily traffic within a week for the south approach

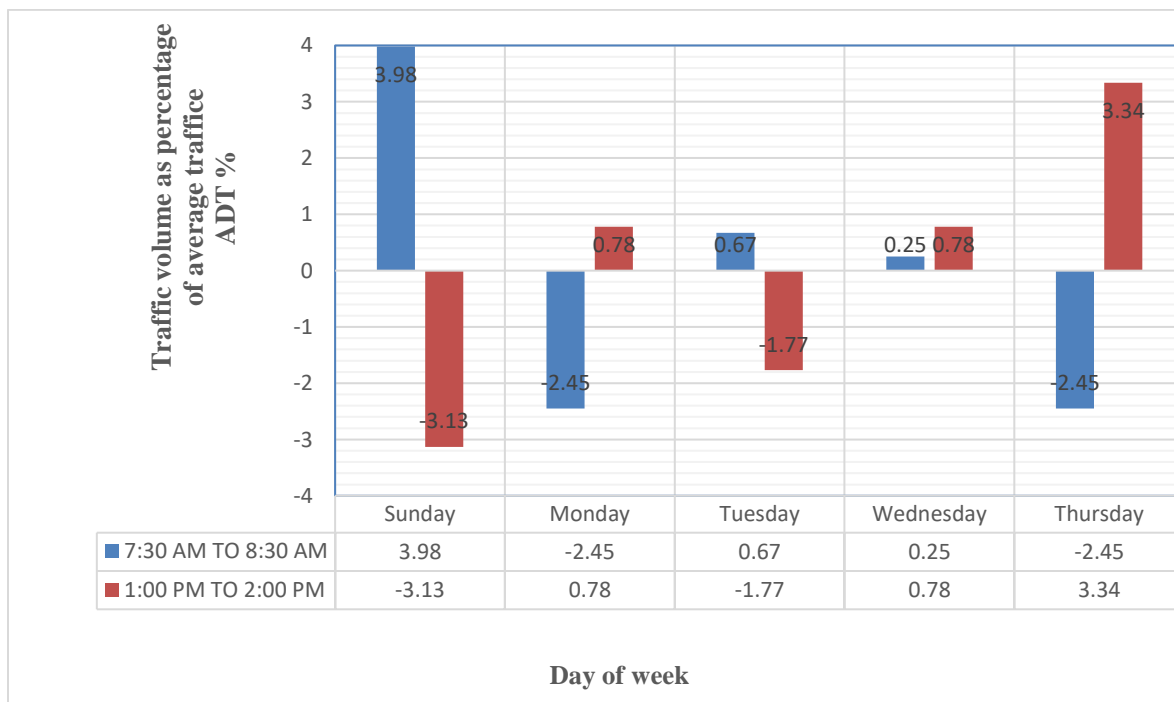


Fig.11 Variation of Traffic Volume as Percentage of ADT South Approach

8. AVERAGE DAILY TRAFFIC (ADT) ESTIMATION

The average daily volume of traffic (ADT) is average volumes for more than a day and less than a year. The ADT calculations for the intersection, lasted from (20/1 to 14/3) 2019 for each approach and for each direction of movement, the results of the field data

show the convergence of traffic volumes for each approach during the selected three months, and the traffic volumes vary from one approach to another, see Figure (12).

Where the western approach recorded the highest volume of traffic (1735, 1750, 1739) Pcu/hour for the months of January, February, March respectively, and the eastern approach (1556, 1551, 1572) Pcu/hour for the months of January, February, March respectively. The reason is that Jihad Street is a link between Palestine arterial Street and (Bab Al-Muadham Station). It was mentioned in advance that the (Bab al-Muadham) is the Center of Baghdad city which attracts higher daily trips, the results of the Southern Approach were (1477, 1396 and 1495) Pcu/hour during the three months of January, February and March, respectively, The Northern Approach results were the lowest (1035, 1013, 1054) Pcu/hour for January, February and March. The reason for the lack of traffic volumes on this approach is that the road linking it with Palestine Street is closed.

Figure (13) show average daily traffic for three months per approach, ADT for north approach was (1034) pcu/day, East approach (1559) pcu/day, West approach (1741) pcu/day and South approach (1456) pcu/day.

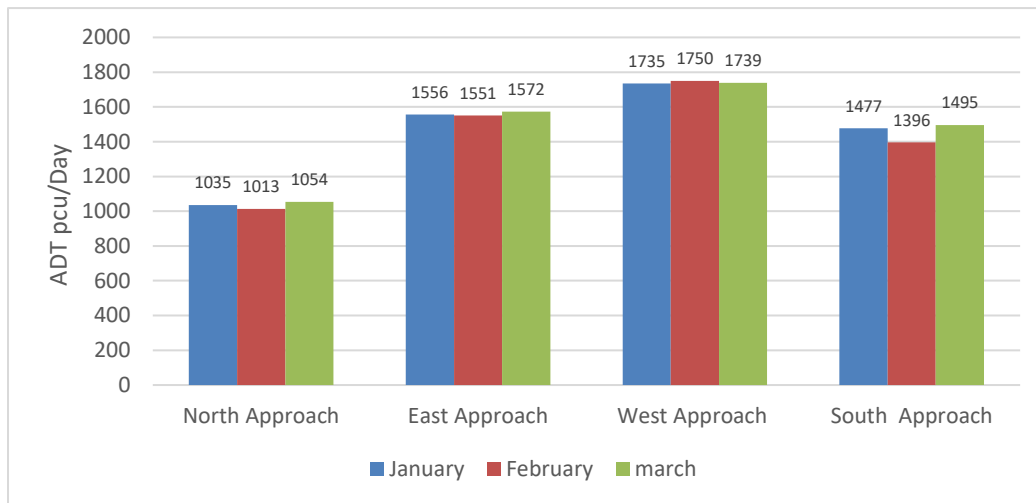


Fig.12 Average Daily Traffic (ADT) for Three Months for Each Approach

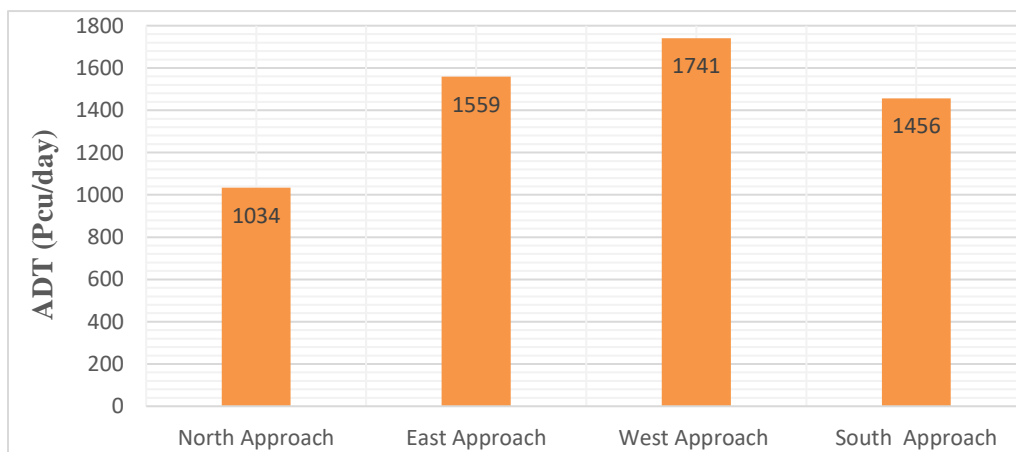


Fig.13 ADT for each Approach

Figure (14) shows the ADT per direction of movement for each approach. In the eastern approach the average traffic volumes for the directions (Left, Throw, Right) (441, 921, 198) Pcu/hour respectively, in the western approach the average traffic volume for the directions (left, Throw, Right) (384, 1018, 339) Pcu/hour respectively, the largest volume of traffic is observed in the direction of (Throw) from Palestine Street towards (Bab Al-Muadham) in the morning rush hours and reverse in evening rush hours, In the Southern Approach, the ADT for traffic volume in the directions (left, Throw, Right) was (1122, 140, 194) Pcu/hour respectively, note that the highest volume of traffic is in the left direction movement towards the west (Bab Al-Muadham) which attracted crowded of daily educational and work trips, In the northern approach ADT traffic volume average for the directions (left, Throw, Right) was (227, 207, 550) Pcu/hour respectively.

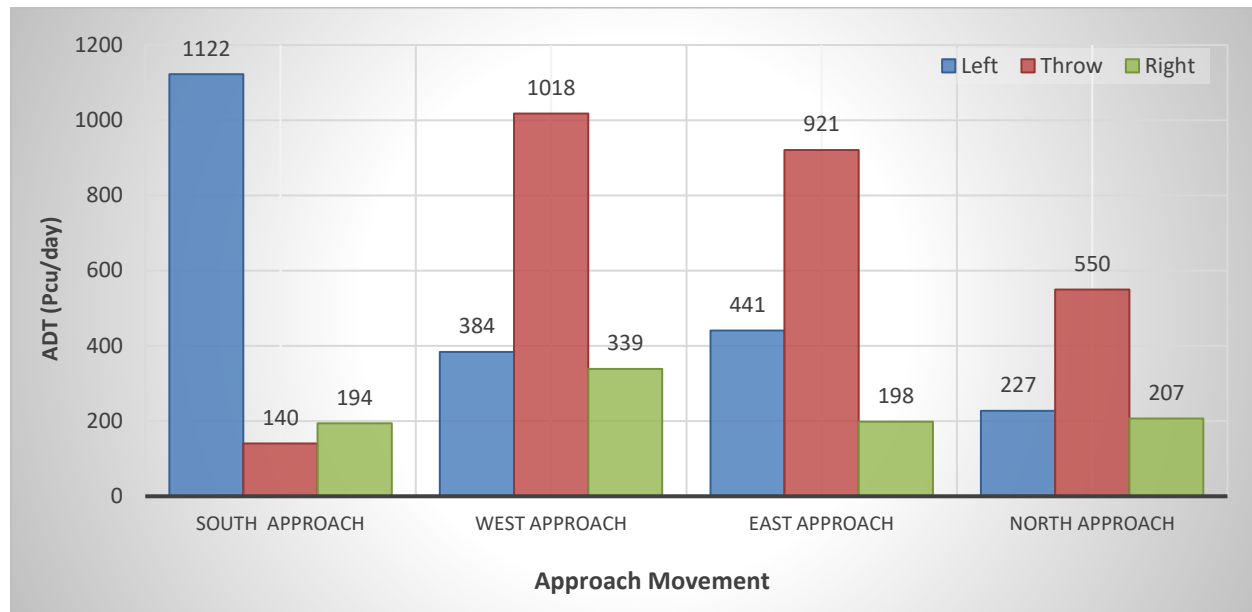


Fig.14 Average Daily Traffic per Direction for Al Turkmani Roundabout

9. CONCLUSION

The following concluding remark can be recorded:

1. Maximum traffic volume for the north approach (Jamal Al-Din Street) of 1028 (Pcu/hour) is recorded for (7:30-8:30) a.m. on Tuesday and 1097(Pcu/hour) is recorded for (1:00-2:00) p.m. on Monday.
2. Maximum traffic volume for the South approach (Jamal Al-Din Street) of 1728 (Pcu/hour) is recorded for (7:30-8:30) a.m. on Sunday and 1292 (Pcu/hour) is recorded for (1:00-2:00) p.m. on Thursday.
3. Maximum traffic volume for the west approach (Al-Jihad Street) of 1531(Pcu/hour) is recorded for (7:30-8:30) a.m. and 2060 (Pcu/hour) is recorded for (1:00-2:00) p.m. on Wednesday.
4. Maximum traffic volume for the East approach (Al-Jihad Street) of 2023(Pcu/hour) is recorded for (7:30-8:30) a.m. and 1192 (Pcu/hour) is recorded for (1:00-2:00) p.m. on Monday.
5. The obtained results of average daily traffic for the North approach are (1035, 1013 and 1054) veh/day for three months (January, February and March) respectively.
6. The obtained results of average daily traffic for the South approach are (1477, 1396 and 1495) veh/day for three months (January, February and March) respectively.
7. The obtained results of average daily traffic for the East approach are (1556, 1551 and 1572) veh/day for three months (January, February and March) respectively.
8. The obtained results of average daily traffic (ADT) for North, South, East, and West approaches are (1034, 1456, 1559 and 1741) veh/day respectively.

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